Forest Protection Against the Spruce Budworm — 1963

U. S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE,

INTERMOUNTAIN REGION

AND

COOPERATING AGENCIES

FOREST PROTECTION AGAINST SPRUCE BUDWORM
SOUTHERN IDAHO AND ADJOINING MONTANA AREAS
1963

Administration by the U. S. Department of Agriculture, Forest Service, Intermountain Region in cooperation with the:

IDAHO STATE FISH AND GAME DEPARTMENT
IDAHO STATE DEPARTMENT OF FORESTRY
IDAHO STATE DEPARTMENT OF AERONAUTICS
INTERMOUNTAIN FOREST PEST ACTION COUNCIL
U. S. BUREAU OF LAND MANAGEMENT
U. S. WEATHER BUREAU
U. S. AGRICULTURAL RESEARCH SERVICE
U. S. FISH AND WILDLIFE SERVICE
U. S. FEDERAL AVIATION AGENCY

FOREWORD

The successful control in 1963 of a serious infestation of spruce budworm covering some 190,000 acres on the Targhee National Forest and 18,000 acres of adjoining lands administered by the U. S. Bureau of Land Management, is reported herein. In addition, control strategies for subsequent suppression activities were devised and tested on a 16,500 acre test area on the Salmon National Forest and a new insecticide was tested on a 10,000 acre area on the Targhee National Forest. The new patterns in control technique developed for these projects comprise a significant advance in forest protection concepts. Through such new developments, multiple use land management in all its complex facets will continue better to serve the public objectives.

In accomplishing the project reported herein, the U. S. Forest Service has made fullest possible use of adaptable modern techniques and the best skills and knowledge available to secure maximum control with a minimum of adverse side effects.

The primary objective was reduction of damage to the Forest resource but at the same time considerable effort was devoted to devising better and more effective means of spraying, and to the development of safer materials and equipment so that future projects might benefit.

Any successful project in the public service is essentially one of cooperation. An expression of thanks and appreciation is, therefore, extended to those who contributed their skills and their aid, and to those in the public information field who were so generous with their time and facilities.

The report highlights the major features of the control operation.

Floyd Iverson

Regional Forester

INTRODUCTION

Foresters throughout the United States recognize the spruce budworm, *Choristoneura fumiferana* (Clem.), as the most widespread and potentially destructive forest insect. Long troublesome in Intermountain Douglas-fir forests, the insect currently is occurring in both outbreak and potentially-outbreak proportions on six National Forests of the Region; a condition which has been brewing since 1958.

In the Fall of 1962, spruce budworm infestations in the Region covered over 1.5 million acres of valuable forest lands. The infestations had been increasing steadily for several years. Damage was intensifying and losses were mounting. The time was on hand when control action would have to be initiated if serious losses were to be averted.

The area of infestation was too large to be sprayed in one year's operation so a three-year program was planned with the basic strategy calling for spraying first the areas carrying the heaviest insect populations. It was originally planned to spray nearly one-half million acres in 1963, much of which was on the Salmon National Forest and included important salmon-producing waters. Early in the planning stages, however, came recognition and concern that there was no positive guarantee against insecticide reaching salmon waters and, therefore, it was not possible to say definitely what might happen to aquatic life in these streams. Weighing further timber losses against the possibility of some loss of fisheries values, it was decided to defer spraying in that area and accept the timber loss for at least another year, meanwhile devising a means of spraying and protecting such areas by having positive safety mechanisms built into the system. This deferment represented risking a material loss in growth and important losses among young trees but this risk was taken in order not to incur major losses of fisheries values.

The primary control effort in 1963 was, therefore, transferred to the Targhee National Forest and the adjoining infestation in Montana in Bureau of Land Management timber stands. Prior to spraying this control area, a test of the protective techniques devised for the Salmon National Forest area was made in the Hughes Creek area in that National Forest. Results were apparently quite favorable and the needed protective techniques were applied to the Targhee National Forest with equally good results.

Under the Forest Pest Control Act of 1947, the U. S. Forest Service has primary responsibilities for protection of the Nation's timber resources from insect and disease pests. Under the Act. cooperative projects are encouraged whenever land ownerships other than Federal are involved. In this project, the State of Idaho financed the spraying of State owned timberlands within the infested area in the common effort to protect the threatened forests.

Young Douglas-fir trees stripped of foliage by spruce budworm. Such damage may wipe out an entire generation of young trees unless they are protected.

SUMMARY

The 1963 spruce budworm project was executed in two phases. The first was to test the adaptability of aerial spray techniques developed to protect aquatic resources and fishery values. This test was carried through on the Hughes Creek Area, Salmon National Forest, June 30 through July 3. Project headquarters were at Salmon, Idaho with flying done from the Salmon Airport.

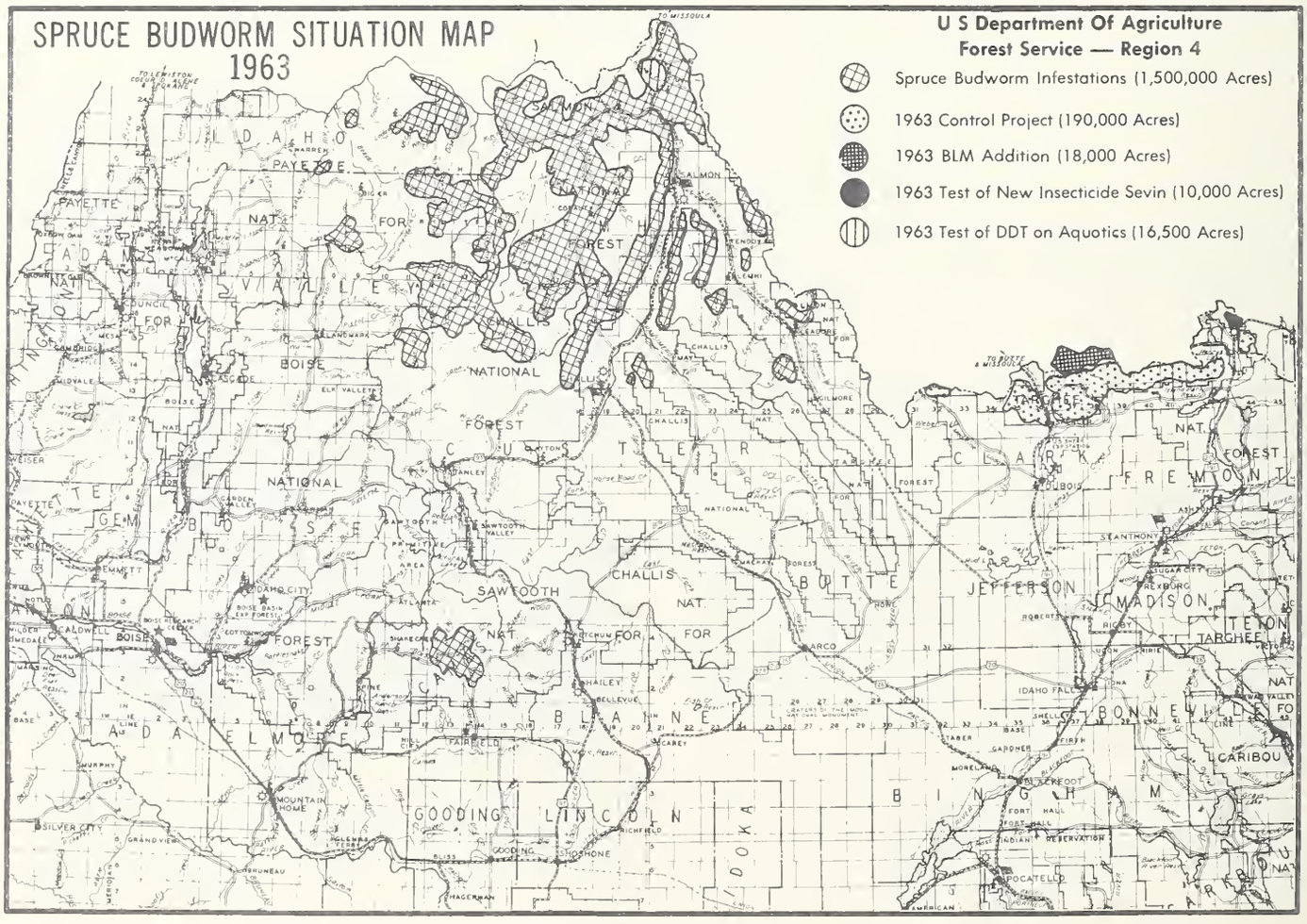
The second phase, comprising the control operation itself, began July 10 and continued through July 24. Included in this phase were the spraying of 190,000 acres on the Targhee National Forest and 18,000 acres of infested Bureau of Land Management timberlands adjoining. In addition, on the Targhee National Forest, a preliminary test to appraise the effectiveness, specificity, and safety of a newly recommended pesticide was conducted on 10,000 acres. Project headquarters for this phase were at the Dubois Municipal Airport, Dubois, Idaho.

Statistical Summary

Total cost of project — $276,000
Total acreage — 234,500*
Total cost per acre — $1.23
Total man-days — 2,865
Total gallons insecticide—221,000 (DDT) 6,900 (Sevin)
Total airplane hours — 732 Observation & Administration plus 200 Spraying
Lost time accidents — None

Post project checks showed spruce budworm mortalities ranging from 66 to 99 percent. The overall average reduction on the one-half pound per acre areas was 91 percent. On the areas which received one pound per acre application, reductions averaged 97 percent. Experience has shown that 95 percent or better mortality ordinarily provides adequate control.

*Includes Targhee National Forest - 190,000 acres control area - Idaho
Targhee National Forest - 10,000 acres test area - Idaho
Salmon National Forest - 16,500 acres test area - Idaho
U.S.D.I., BLM Lands - 18,000 acres control area - Montana



ORGANIZATION AND PLANS

The project was organized as a subunit of the Regional Office, Division of Timber Management in order to facilitate the widespread operation which involved two National Forests, and included spraying on Bureau of Land Management and the State of Idaho lands. All the operational elements including fiscal control were handled by the project leader and his assistants on detail to the project from regular assignments elsewhere. The overall job which included development of control strategy for the two units, coordination of activities with other Federal and State agencies, and administration of contractual services was thus greatly facilitated.

Mr. Floyd Iverson retained general project direction as Regional Forester because of the interregional and national aspects, and to assure essential coordination with multiple use management. Operating staff personnel worked under the direction of Joel L. Frykman, Chief of the Division of Timber Management. The following men were selected for particular skills from among Regional Office and National Forest staffs. Those in direct charge of specific project functions were:

Project Position	Name	Official Title	Home Unit
Project Leader	Richard C. Stemple	Forester	Cache N. F.
Ass't Project Leader	Roger Taynton	Forester	RO, TM Division
Air Officer	Karl Bryning	Reg. Air Officer	RO, FC&S&PF
Entomologist	Jerry A. E. Knopf	Entomologist	RO, TM Division
Safety Officer	Gary White	Adm. Trainee	Boise N. F.
Administrative Officer	Blaine Bowen	Adm. Officer	Fishlake N. F.
Unit Supervisors:			
Salmon N. F.	Orlo Johnson	Dist. Ranger	Salmon N. F.
Targhee N. F.	Robert Patee	Dist. Ranger	Targhee N. F.
Information Officers:	Lowell J. Farmer	Forest Pathologist	RO, TM Division
	Victor Goodwin	Forester	Humboldt N. F.

Other personnel, serving in the following fields, were recruited locally from among college students or wherever skills were available: Maps, photography, fisheries biology, unit assistants, unit air officers, unit radio officers, unit safety officers, weather observation, aerial observation, unit biology, insect checking, helicopter foremen, load checkers and night watchmen.

The balance between local administration and project management was maintained at all levels through direct coordination by the project leader and his assistants with local National Forest personnel and others involved. The respective Forest Supervisors F. E. Powers, Salmon National Forest and Alvin Wright, Targhee National Forest thus were enabled to keep local functional protection and management activities synchronous with multiple use administration.

Preparation of functional plans was directed by the project leader and coordinated by him with the Forest Supervisors for all plans and instructions issued. The following functional plans and contracts provided the basis for the overall project execution:

Operational Plans	Technical Plans	Contracts
Targhee National Forest Control Unit	Entomological Activities	Aerial Services
Salmon National Forest Test Unit	Salmon National Forest Test Unit	Insecticide
Sevin Test Unit	Sevin Test Unit	
Safety		
Information and Education		

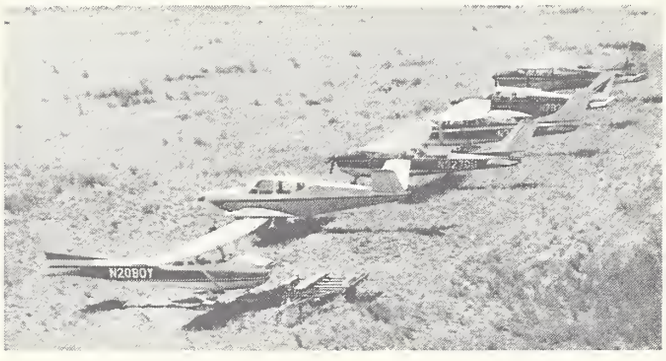
TEST AREAS AND CONTROL OPERATIONS

Declaration of Zones of Infestation

State of Idaho law requires the designation of "Zones of Infestation" before treatment of large acreages of forest insect infestations is attempted. Declaration of the suppression areas as "Zones of Infestation" was made by State Forester Roger L. Guernsey on June 26, 1963.

Aircraft, Equipment and Supplies

Aerial spraying of rugged mountainous country is complex and hazardous, requiring painstaking preparation and careful administration. Not only must all of the aircraft suitability requirements be satisfied, but adequate equipment and materials for an acceptable suppression job must be assembled and available for use at the critcial time in insect development. Timing and coordination are paramount because the period of budworm susceptibility to spray is measured in hours and days. For these reasons, as well as for safety, controls to assure high caliber performance are written into the contracts issued for commercial bidding.



Lineup at the Dubois, Idaho airstrip. They were small aircraft used for spray control observation, scouting, and to familiarize spray pilots with their assigned spray blocks.

The contract for pesticide, transportation, and storage of the one pound DDT solution was awarded June 7, 1963 to the Lennington Chemical Corporation of Anacortes, Washington at $0.373 per gallon. The one-half pound DDT mixture was bid and accepted at $0.287 per gallon by the same Company. The contractor installed large pesticide storage tanks at the Salmon and Dubois landing fields in order to have an adequate supply of insecticide on hand when needed. To assure uniform quality, samples of all batches of DDT used were laboratory tested and the results of the tests were transmitted currently to the project leader.

Spray aircraft parked on the airstrip at Dubois, Idaho. Flying time was usually from about 4 a.m. to 10 a.m. on days when weather conditions were satisfactory for safe, effective work.

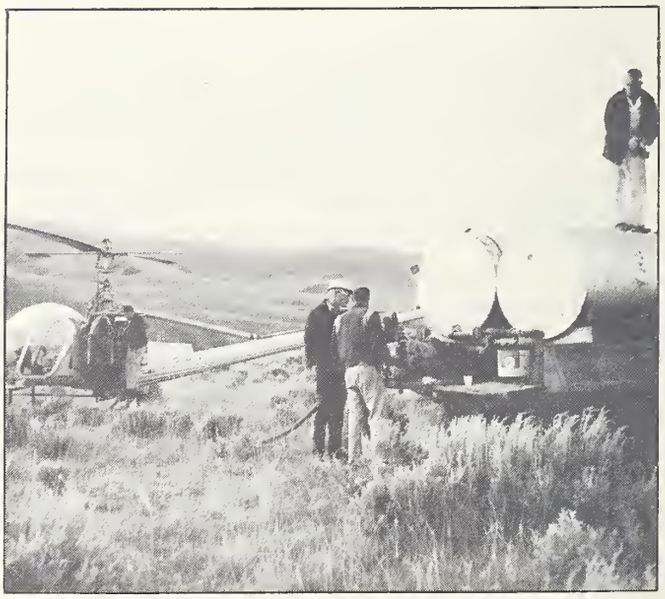
The contracts for aerial services were awarded to the Aurora Air, Inc. of Madras, Oregon and Hillcrest Aircraft Company of Lewiston, Idaho as follows:

Aurora Air, Inc

Spray Craft (Fixed-wing) - $ 0.277 per acre
Spray Craft (Helicopter) - $ 1.00 per acre
Observation Aircraft - $30.00 per hour

Hillcrest Aircraft Company

$0.485 per acre
$ 2.90 per acre
$38.00 per hour



Servicing a helicopter which is operating from a temporary heliport near the spray unit.

Aurora Air Inc. received the contract for aerial application of insecticide on the Targhee National Forest Control Unit. Hillcrest Aircraft Co. was awarded the contract for aerial application on the Salmon National Forest Test Unit and this Company also provided flying service on the Targhee National Forest Sevin Test Unit.

Safety and suitability inspections of contractors' aircraft were made by Project Air Officer Karl Bryning at Lewiston, Idaho for Hillcrest Aircraft Company on June 24, 1963 and at Madras, Oregon, July 1, 1963 for Aurora Air, Inc.

Aircraft used on the individual projects, together with average capacities, were:

Salmon National Forest Test Unit

Type of Aircraft	*Unit Allowable Pesticide Capacity*	*Average Spray Swath Width*
Spray Craft		
2 TBM's	700 Gal.	400 Ft.
1 Helicopter	Average 70 Gal.	50 Ft.
Observer Craft		
4 Airplanes	———	——
1 Helicopter	———	——

Targhee National Forest Control Unit

Type of Aircraft	*Unit Allowable Pesticide Capacity*	*Average Spray Swath Width*
Spray Craft		
1 Helicopter	Average 50 Gal.	50 Ft.
1 TBM	700 Gal.	400 Ft.
1 C-39	1,000 Gal.	500 Ft.
2 B-17's	2,000 Gal.	600 Ft.
1 B-26	1,000 Gal.	400 Ft.
1 PV2	1,000 Gal.	400 Ft.
Administrative and Observer Craft		
1 Helicopter	———	——
10 Airplanes	———	——

Targhee National Forest Sevin Test Unit

Type of Aircraft	*Unit Allowable Pesticide Capacity*	*Average Spray Swath Width*
Spray Craft		
1 TBM	700 Gal.	400 Ft.
Administrative and Observer Craft		
2 Airplanes	——	——

The Mechanics and Design of Control

Successful control of spruce budworm requires application of pesticide when budworm larvae are at a stage of development where they are particularly susceptible to spray. The so-called critical stages are established by entomologists after repeated sampling and classification of the budworm populations, unit by unit.

Ordinarily, except for some local influences by climate, larvae in mountainous country at the lower elevations begin feeding first in the spring. Then as the higher country warms, the budworm development pattern moves progressively upward. Pesticidal application follows a similar pattern; treatment moves from lower to higher country as critical stages in larval development are reached.

A spray block designated on a lapboard of the type used by spray pilots and observers. The gauge in the pilot's left hand designates the number of spray swaths needed in each area.

Advantage was taken of this pattern of development to perform control tests at the lower elevations in the Salmon National Forest a week prior to "readiness" for spray of the higher infested country on the Targhee National Forest.

The Tests on The Salmon National Forest

Since these tests involved treatment in important salmon and trout producing areas, Idaho State Fish and Game Department personnel cooperated in designing certain of the studies concerned with checking the success of the spray patterns for protecting waters and aquatic life.

The spray pattern tested on the Salmon National Forest was as follows:

1. No spray within 100 feet of selected streams, lakes or reservoirs.

2. In a 300-foot zone occurring between 100 feet and 400 feet from the water's edge, one-half pound of pesticide per acre was applied by helicopter for maximum control of spray deposit.

Live young fish captured and placed in a "live-box" for the Salmon National Forest spray application test.

3. Beginning 400 feet from the water's edge a 600-foot strip was sprayed by fixed-wing aircraft at a rate of one-half pound of pesticide per acre.

4. On the remainder of the infested area beginning 1,000 feet from the water's edge, one pound of pesticide per acre was applied by fixed-wing aircraft.

The Hughes Creek area, having been previously selected for tests, a 16,500 acre area was flown as prescribed above during the period of June 30 through July 3. Preceding the flights, members of the Idaho State Fish and Game Department and the Forest Service checked stream fish populations and other aquatic organisms and placed "live boxes" at designated places in the streams. Rechecks of the populations during and following treatment supplied adequate information to appraise the effectiveness of the spray procedures. Sampling procedures on spruce budworm larvae were designed so that both prespray and postspray population densities could be determined for each different spray zone and dosage.

The Idaho State Fish and Game Department handled the water analyses for detecting the presence and concentration of DDT, gathered data on fish survival in the "live boxes," and sampled the changes in aquatic insect populations. Such insects comprise an important segment of fish population feed. Types of fish used in the sampling were chinook salmon fingerlings, steelhead trout fry, and hatchery-reared rainbow trout fingerlings.

Water samples were collected hourly during spray days at each of the seven established test stations and three control stations. Fish in the "live boxes" were checked each day from June 27 through July 9, and aquatic insects were sampled according to standard procedures.

Targhee National Forest Control Unit

The 208,000 acre block of infested timber treated extended from the Henry's Lake area on the east to the Spencer, Idaho area on the west along the Idaho-Montana boundary. It included 18,000 acres of adjoining Bureau of Land Management timberland in Montana.

Hiller helicopter spraying a protection strip, Targhee National Forest — according to a prescribed design. Operating at close range to the treetops, excellent spray control is attained.

B-17 laying down a 600-foot swath on the Targhee National Forest control unit. Adherence to the prescribed pattern is checked from an observer aircraft in the vicinity.

Within the area prior to treating, project personnel selected West Camas Creek and Howard Creek for another pattern of control testing:

1. No spraying within ¼ mile of the water's edge.

2. From ¼ to ½ mile from the water's edge, the pesticide was applied at the rate of one-half pound per acre, by fixed-wing aircraft.

3. The remainder of the infested area received a one-pound-per-acre application, by fixed-wing aircraft.

Since stream bottoms in the area often were within wide expanses of untimbered brush and meadowland, the strips listed under points 1 and 2 above frequently contained wider strips of unsprayed area than indicated in the pattern description.

On the remainder of the area, streams designated by the Forest Rangers and State Fish and Game Department personnel for special treatment, were sprayed in the same manner as the Salmon National Forest Test Area.

Fixed-wing aircraft which flew this project during the period July 10 through July 24, were headquartered at the Dubois, Idaho airfield. Mobile headquarters were employed to conduct the helicopter portions of the flight patterns.

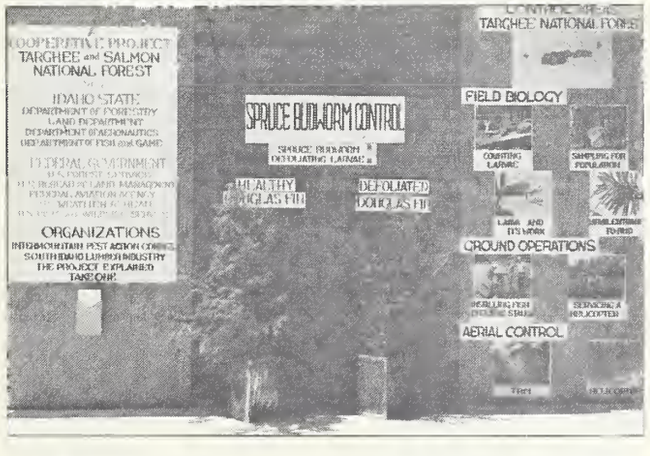
Targhee National Forest Sevin Test Area

Approximately 10,000 acres of the Targhee Creek drainage were selected for a project area to test the effectiveness of a newly developed insecticide named "Sevin." Flights with fixed-wing aircraft were made July 14 and 15, depositing "Sevin" at the rate of 1.6 pounds per acre on roughly one-fourth of the area; 0.8 pound per acre on one-fourth of the area; with the remaining one-half of the area comprising check areas for the two different concentrations used.

A heavy rainstorm shortly after spray deposition may have nullified the tests because results were mostly negative. Additional tests will be needed before the effectiveness of the pesticide can be adequately appraised.

PUBLIC INFORMATION

The public has far-reaching interest in the general use of pesticides and their application, especially with regard to side effects and public safety. An important segment of the operation, therefore, was to assure that all possible interested people were informed of operations both before and during spraying.



All the public cannot witness what is being accomplished on the control project. Therefore, it is brought in miniature to them. Such exhibits helped people understand the size, the complexity, and the need for protection of the forest against pests.

Mimeographed materials summarizing the operational plans were prepared and sent to individuals and cooperating agencies both inside and outside the Intermountain area. In addition, detailed information on each phase of pesticidal application was placed in the hands of all operating and cooperating personnel so that pertinent questions could be answered intelligently.

An informational illustrated leaflet showing the life cycle of the insect, its damaging qualities, and the salient points of the spray operation was given general distribution. This, plus excellent press, radio, and TV coverage, gained for the project full public understanding and support. Locally at the centers of operation in Salmon, Dubois, and Island Park, Idaho, exhibits depicting the project received considerable notice.

Project personnel were indebted to the metropolitan, local, and county press, and to the radio and television outlets for the splendid coverage given project activities. The success of the information program was in no small part due to this effort.

OPERATIONAL DETAILS

Communications

The entomological crews were headquartered where telephones were available to communicate information to project headquarters on blocks "ready to spray," and to report inadequacies in spraying. To maintain rigid controls on all spraying, radio communications were provided as follows: (1) field headquarters to all aircraft, (2) aircraft to aircraft, (3) field headquarters to weather stations, (4) field headquarters to regular forest units. The regular National Forest radio frequency was used on the latter two systems.

Observer and Pilot Responsibility

1. *Spray Pilots.* Spray pilots were assigned individual spray blocks and were responsible for the satisfactory treatment of those blocks.

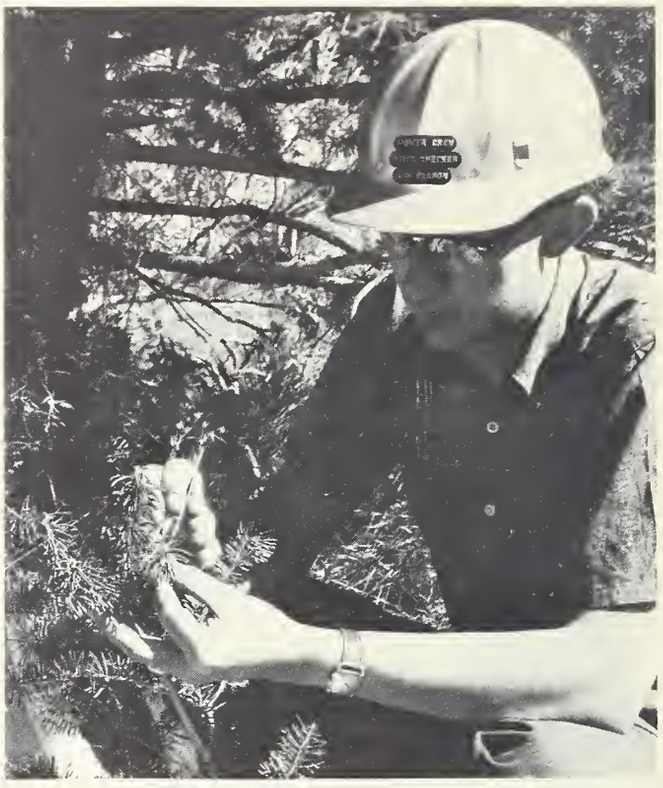
2. *Aerial Observers in Small Aircraft.* One aerial observer worked with each spray pilot helping direct the application of spray, checking spray coverage on "lapboards," observing spray distribution, and noting drift. Information on excessive drift occurrence was immediately radioed to headquarters. Correlation of information from field weather stations, observers, and field headquarters formed the basis for closing operations or for transfer of pilots to other spray blocks where spray conditions were still favorable.

Entomological Services

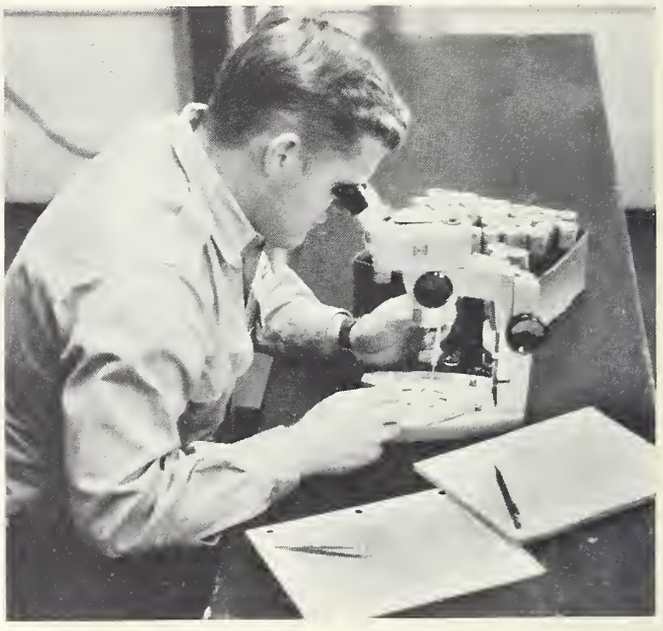
Because of the rapidity of the insects' development during the cyclical phases most susceptible to spray, hour-by-hour correlation between the entomology field staffs and unit control headquarters is essential. Thus, critical larval development and spray treatment are synchronized through prompt accurate field evaluations and designation of spray blocks ready for treatment. This type of entomological service is especially important because of the speed and efficiency with which large areas of infested timberlands are brought under the suppression pattern using modern aircraft and technical developments.

Spray blocks are selected by natural boundaries such as ridges, streams, and roads for easy identification from the air and for uniformity of topography. A major consideration in these decisions is the ease of designating larval development zones and segregation into convenient safe flight patterns.

A final duty of the entomologists is to judge the relative success of the project as indicated by degree of larval mortality.



Data from field biologists set the areas "ready for spray" based on larval development. Checks after the flights also established the effectiveness of spray judged by percentages of the insects killed.



Susceptibility to spray was judged on a basis of the stage of development of the larvae. A larva's stage is established by the width of its head capsule, not by body size.

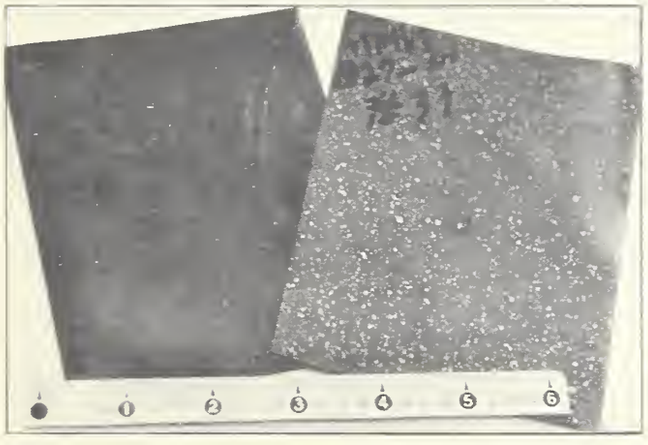
Measurement of the spraying quality is made in three parts; first, the establishment of insect population levels just prior to spraying. secondly, the check of spray deposition and spraying operations, and third, the evaluation of spray deposition and larval mortality after spraying. Such evaluations help form the basis for acceptance or rejection of the treatment. Thus, checks are made immediately following spraying to assure re-treatment if needed while the larvae are still susceptible for maximum kill.

Assurance of Adequate Performance

1. *Pilot Guides.* In addition to group instruction on flight patterns, each pilot was taken over his assigned flight areas prior to spraying to become familiar with terrain and prescribed method of coverage. Designated spray blocks were outlined on aerial photo mosaics and maps mounted on 16" x 24" hardboard for convenience of handling during flight. These "lapboards" contained all essential information needed by the pilots to assure complete coverage.

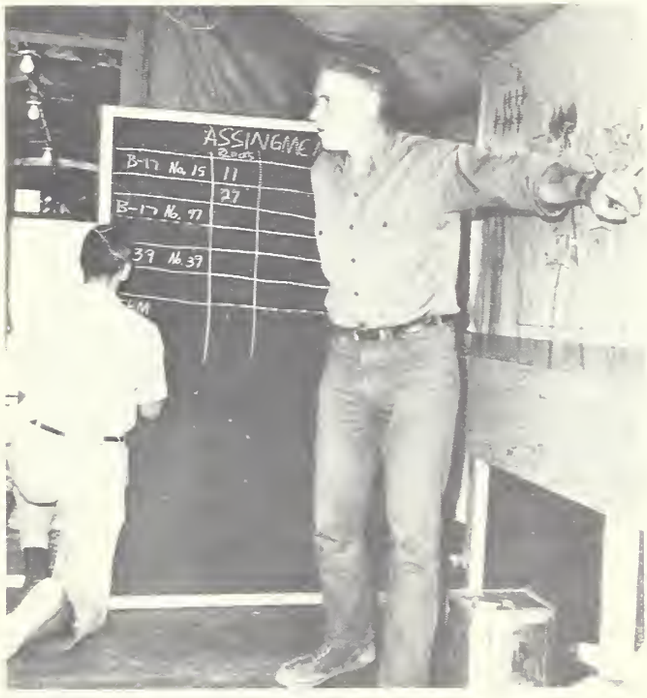
2. *Weather Observation.* Personnel at portable weather stations located strategically in areas under treatment radioed half-hourly and hourly weather data to the unit leaders. This information was used as the basis for operation controls.

Spraying operations were stopped when wind readings reached six miles per hour and temperatures reached 68° F. These precautions prevented excessive spray drift and dissipation of insecticide.



Such oil sensitive cards as those shown translated the amount of spray deposit on each block treated. Cards were staked to the ground on sample strips through the trees. A key translates the coverage into gallons of pesticide deposited per acre. These data plus the gallonage of insecticide delivered to the planes, plus the larval mortality data, formed the basis for judging the effectiveness of suppression, block by block.

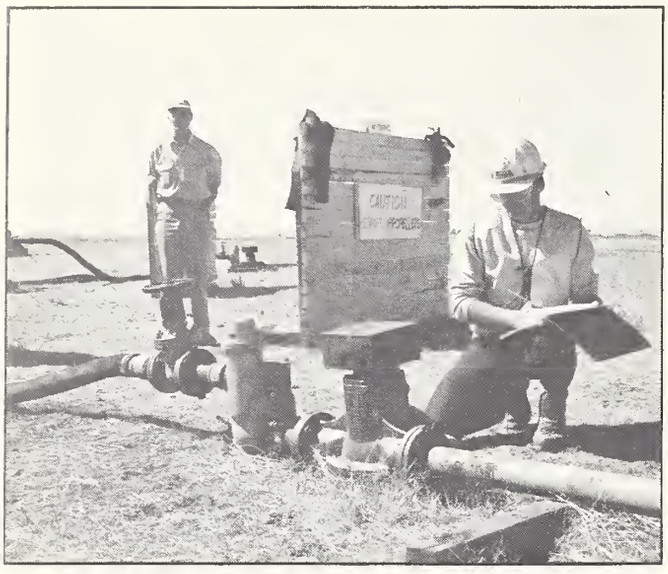
After 9 a.m. each day the unit leaders radioed essential weather information to the U. S. Weather Bureau at Boise, Idaho. These readings were used by Weather Bureau personnel together with other general information to prepare accurate spot weather forecasts which were radioed daily at 4 p.m. to unit headquarters.



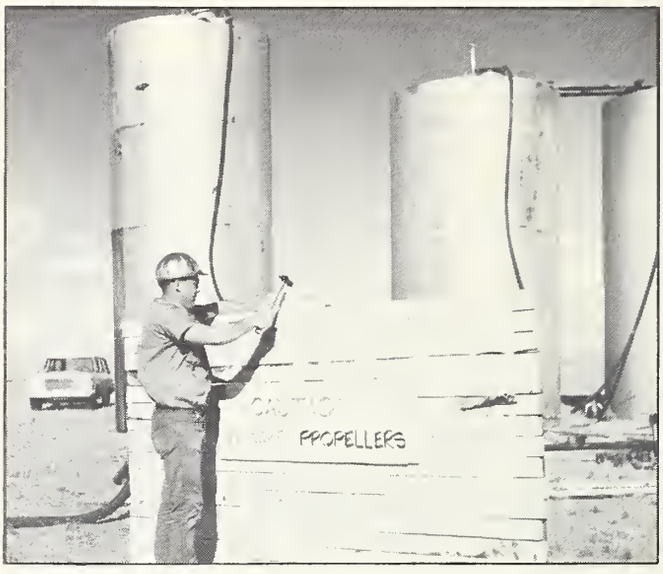
Spray block assignments, plane schedules — in and out, and spray progress were three important elements requiring minute-by-minute coordination.

Incoming weather reports from area mobile weather stations to field headquarters gave the basis for operational control of current flights as well as flying plans for the following day.

3. *Safety.* The project safety plan, covering all phases of flight and field operations was administered by a project safety officer. Personnel on each functional phase were personally responsible for safety in their operation. Unit supervisors conducted daily safety meetings to encourage individual participation and keep everyone informed on the changing hazard pattern. This safety-consciousness resulted in an extremely hazardous project being completed without loss of time due to accidents.



Field personnel kept accurate records on the insecticide metered into spray planes. Note safety barrier to protect field personnel while planes were on the field.



Pesticide storage tanks at the Dubois airstrip. Signing, daily safety meetings and assignment of individual responsibility were elements that gave the project an A-1 safety record.

RESULTS AND CONCLUSIONS

Since DDT was applied at two rates of one-half pound and one pound per acre respectively, according to the established patterns of application, larval mortality throughout the project was sampled separately for each of the two rates of application. About 68,000 acres, nearly one-third of the total sprayed area, received the one-half pound treatment. The remaining area received one pound per acre except for selected stream courses where 5,250 acres received no spray.

The mortality surveys on the Targhee National Forest Control Unit showed the one-half pound application rate to be an undependable suppressive measure. Nineteen sampling lines established in the one-half pound areas ranged from 66 percent to 97 percent mortality. The average for the nineteen lines was 91 percent. Mortality averaging 95 percent or higher is considered acceptable for control.

On the portions of the thirty spray blocks which were treated at the one pound per acre rate, reductions in larval populations ranged from 91 to 99 percent with the average larval mortality for these areas being 97 percent.

The ratios of mortality on the Salmon National Forest Test Unit corresponded closely to those attained on the Targhee National Forest Control Unit. The tests demonstrated that the spray procedures devised, if adhered to closely, would provide adequate protection to the fisheries resource, as the loss of fish in the live boxes was quite minor and no losses to the native populations were noted. Aquatic insect populations were reduced considerably immediately after spraying but are expected to rebuild rather quickly.

The substantial reduction in the budworm population on the majority of the project area, which resulted from the spraying, should effectively relieve the timber stands from the damaging affects of successive years of defoliation and remove the immediate threat to the timber resource. Still to be assessed are the long term affects in terms of budworm population rebuilding as a result of modified spray procedures.